Massachusetts Division of Energy Resources

Massachusetts Department of Housing and Community Development

REBUILD MASSACHUSETTS
ENERGY INFORMATION SYSTEM
PROJECT UPDATE

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Executive Summary

This report provides an update on the Energy Information System ("EIS") Project supported by the Rebuild Massachusetts Program (Rebuild MA) and the Rebuild Massachusetts Public Housing Energy Efficiency Project (PHEEP). Funded by the US Department of Energy, both of these programs support energy conservation and efficiency in priority target sectors, including schools, municipalities, and public housing (PHEEP). Outreach includes coordinating existing resources by identifying development opportunities to increase incorporation of energy and water efficiency in buildings where other public and private investments are occurring. The Massachusetts Department of Housing and Community Development (DHCD) is the lead agency managing PHEEP in partnership with Rebuild MA. Additionally, the Program benefits from strong support provided by most of the state's major electric and gas utilities, the Northeast Energy Efficiency Council (NEEC), and both state and local government officials.

As previously reported[1] the purpose of the EIS Demonstration Project (Project) was to determine whether a customized, web-based energy information system can eliminate the barriers that prevent public agencies in Massachusetts from gaining access to, and making effective use of energy information, and thus enable those agencies to implement energy efficiency projects. Because of the barriers listed in the first report, many public agencies do not have useable energy information and, consequently, numerous energy efficiency opportunities are being lost. Based on the positive results of the demonstration project, work has increased to a larger scale implementation project.

The core features of the EIS include electronic collection of utility data and Web publishing to provide timely information to many people in many locations. Through electronic data collection and reporting, the system reduces time and effort for users and promotes data consistency.

Over the first phase, the demonstration project activities included:

- Work with the agencies and their utility providers to collect utility and building data
- Create data tables and populate them with the utility and building data
- Establish a secure central server to store the data

Lessons learned over the first phase concerned the collection of utility and building data.

As a follow up to the initial pilot project, the implementation project's priority was to scale up the level of activity to collect utility and building data more accurately, more efficiently, and for more facilities. In addition, the implementation project focused on opportunities to expand and improve the quality of the reports individual agencies receive from the EIS. The net impact of these changes has created a robust utility bill management tool that can provide timely, accurate, and easy to access energy information for city, state, and federal facility and utility budget managers.

Over the second phase, the implementation project activities included:

- **Expanding the scale of utility data that is collected**, increasing the number of utility accounts reported by more than 4,000

[1] *REBUILD MASSACHUSETTS ENERGY INFORMATION SYSTEM DEMONSTRATION PROJECT, September 20, 2005* at mass.gov/doer.

- **Adding more agencies**, including 32 state agencies, 11 housing authorities, the City of Cambridge, and the Town of Lincoln
- **Adding environmental emissions calculations**, enabling reporting of emissions of CO2, NOx, and SO2 both in pounds and in car equivalents
- **Enhancing the user interface** by simplifying the navigation structure
- **Adding DHCD monitoring and verification calculations** to enable DHCD and DOER to monitor and summarize energy performance contract utility cost and consumption savings as they occur
- **Collecting utility data for a multifamily energy benchmark project** to identify potential energy savings opportunities
- **Creating "ready to use" standard and advanced utility information reports** to simplify reporting of key information
- **Adding more data entry quality control calculations** to ensure data accuracy
- **Improving data transfer options with investor-owned utilities** to collect more data more quickly and at lower cost

The implementation team worked closely with the investor-owned utility project partners to facilitate the collection of utility bill information. In addition, the implementation team has worked closely with a select group of city and affordable housing building managers to develop effective reports. Following are examples of how the EIS Project has organized, analyzed, and monitored utility bill information.

The EIS Implementation Project

The purpose of the EIS Implementation Project has been to move the EIS Demonstration project (as described previously in the project's first report) into full scale use. Initiated by DOER and DHCD in 2004, the Demonstration Project ran until September 2006. This report covers the results from October 2006 – May 2007.

The report is divided into the following sections:

Section 1: Introduction

Section 2: Energy Information Uses describes the importance of energy information to overcome the barriers that impede public agencies in Massachusetts from gaining access to, and making effective use of, that information.

Section 3: Implementation Project Update describes the agencies targeted by the Demonstration Project.

Section 4: Current EIS Activities

Section 5: Ease of Use Features

Introduction

This report describes the results of the second phase of an Energy Information System ("EIS") Project supported by the Rebuild Massachusetts program (Rebuild MA) and the Rebuild Massachusetts Public Housing Energy Efficiency Program (PHEEP).

Rebuild Massachusetts Program

Rebuild Massachusetts is a state-wide program presented by the Massachusetts Division of Energy Resources to promote energy and water efficiency and support reuse/rehabilitation in schools, municipalities, and public housing. A primary goal is to advocate for and support the adoption and institutionalization of energy efficiency into planning and investment as "business as usual". The program focuses on energy-savings solutions to increase energy efficiency. It offers business and technical tools, customized assistance, and information on alternative financing mechanisms to enable building owners and community leaders to plan and carry out building energy projects, improve building performance, and reduce energy use and costs. The program provides energy efficiency outreach, education, and technical assistance.

The objective is to present state support and leadership to state and local government focusing on energy efficiency & conservation and to disseminate the results as models to communities and stakeholders to stimulate further adoption of resource efficiency as a standard part of planning and implementing energy efficiency investments. The expected outcome of this endeavor is a description of the key barriers relevant to energy efficiency projects and a strategy formulated for their removal.

The feasibility of proposed measures is assessed through analyses of the different strategies, taking into account the local economic aspects including savings potential and financial & staff resources. Further information is available on the Rebuild Massachusetts web site.

Rebuild Massachusetts Public Housing Energy Efficiency Project

The Massachusetts Department of Housing and Community Development (DHCD) manages PHEEP. PHEEP supports efforts to identify, examine, and implement energy and water efficiency investments in state-assisted developments at housing authorities. DHCD partnered with DOER to collect and manage utility bill information for housing authorities with an electronic energy information system. The Energy Information System (EIS) was designed to help DHCD and individual housing authorities better understand, report, and manage energy use and costs.[2]

Looking forward, DHCD proposes to continue to use the EIS to collect utility data for energy performance contract procurements as a reimbursable expense in the energy performance contract. DHCD, DOER, and Rebuild Massachusetts have also agreed to develop a standard energy monitoring and verification report to document utility cost and consumption savings.

[2] The EIS is being used today by DHCD, other state agencies, housing authorities, and cities and towns in Massachusetts, thanks to generous support from the Massachusetts Division of Energy Resources, Massachusetts Department of Housing and Community Development, Massachusetts Executive Office of Energy and Environmental Affairs, the Cape Light Compact, and four utilities: National Grid, NSTAR Electric and Gas, Western Massachusetts Electric, KeySpan

Energy Information Uses

Energy information is the backbone of any successful energy management initiative. Public agencies require energy information for many purposes, including to:

- Review building portfolio performance
- Track spending against budget
- Benchmark
- Identify energy efficiency opportunities
- Package utility and building information for energy efficiency investments, such as energy performance contracts
- Monitor the performance of energy efficiency investments
- Integrate utility monitoring with ongoing operation and maintenance best practices
- Prepare mandatory year-end reports for supervisory agencies such as DHCD

Electric, Gas, Oil, and Water bills are the centerpiece of every energy and water savings investment project that the Program works on. Utility bills help the Program and our Program partners identify high priority energy projects, provide a benchmark of performance for potential savings, and help confirm that targeted energy savings have been achieved. At the same time, however, utility bills are surprisingly difficult and time consuming to collect and analyze. With this in mind, the Program supported an online energy information system (EIS) initiative designed to collect utility bill information electronically and summarize utility bill and building information.

The Energy Information System currently captures utility and building data for several state agencies that include DOER, DHCD, and EEA. In addition, the EIS captures more detailed information for individual clients and a few cities & towns.

The level of information available for any individual building depends significantly on the building's location, utility service territories, and associated building and utility bill database.

Examples of current uses for the EIS include:

- Energy Budget Analysis – The City of Cambridge uses the EIS to collect utility data for every department, to set energy budgets, and to review use and spending against budget. It was very difficult (almost impossible) to summarize the total utility cost and consumption for all city buildings prior to the installation of the EIS.

- Energy Performance Contract Data Collection – The Lynn Housing Authority and Watertown Housing Authority have used the EIS to collect and make available online baseline utility data for proposed energy efficiency investment RFRs.

- Energy Education – The Town of Lincoln has used the EIS to summarize total energy and water cost and consumption numbers for all town facilities. This data will support three major near-term capital investment programs under consideration by the School, Town Building, and Library capital planning committees.

- Energy Performance Contract Monitoring and Verification – The EIS is designed to allow DHCD and DOER to review the same utility bill information individual agencies and energy performance contractors receive. This will allow DHCD and DOER to monitor and summarize energy performance contract utility cost and consumption savings as they occur rather than having to wait for agencies and energy performance contractors to provide this information.

- Building Performance Energy and Water Analysis – The Lawrence Housing Authority used the EIS to collect utility data for a US HUD energy audit. Future energy audits will be able to update the utility bill information automatically through the EIS and building performance indices calculated during the energy audit can be added to the EIS to monitor ongoing building performance.

- Building Performance Benchmarking – The EIS has been designed to allow detailed building benchmarking. New Ecology, a non-profit energy service company, uses the EIS to identify potential energy savings projects for Community Development Corporations. MA DHCD is reviewing all of the agencies "all-electric 667" developments to identify high cost, high use all-electric apartment buildings with elderly residents.

Implementation Project Update

The Implementation Project scope has reflected the varying needs of the Rebuild MA and PHEEP programs.

Rebuild Massachusetts

The EIS Implementation Project supported by DOER has coordinated efforts with Rebuild Partners including the Town of Lincoln, and the City of Cambridge. The EIS project as envisioned will provide a mechanism to 1) prepare reports necessary for establishing performance contract baselines, 2) independently monitor results of energy efficiency improvements, 3) identify high users and spikes for further assessment and troubleshooting, 4) prepare financial reports and budgets, 5) quantify greenhouse gas emissions and savings, and 6) provide reliable utility histories, including various permutations of aggregations, for energy purchase decisions and contracts for state and local government agencies.

DOER included an article about the EIS in the Rebuild Newsletter. The article[3] discussed the challenge of utility bill management and provided three examples how EIS clients have used the system to help manage their utility costs.

Public Housing Energy Efficiency Project

For PHEEP, the Implementation Project has provided DHCD-specific technical support. Specific tasks have included:

- Collect electricity consumption data for all housing authority utility accounts in the National Grid (NGRID) service territory
- Collect and make available three years of baseline utility data for the Watertown and Lynn Housing Authority energy performance contract requests for responses
- Add DHCD's monitoring and verification calculations to the EIS for future third party review of DHCD energy performance contracts

Data Collection and Reporting for Housing Authorities to Date

1. **Building data:** For Massachusetts state funded properties, DHCD has building data for 239 housing authorities encompassing over 7,400 buildings. They also have building data for federally-funded buildings, including, for the New England states:

   MA 169 PHAs, 2,430 buildings
   ME 27 PHAs, 623 buildings
   RI 27 PHAs, 1,059 buildings
   CT 66 PHAs, 2,075 buildings
   NH 17 PHAs, 525 buildings
   VT 9 PHAs, 156 buildings

2. **Electric utility data:** DHCD is collecting electric utility data for 201 housing authorities, with over 8,000 utility accounts. They are collecting data from all four of the state's investor-owned electric utilities: National Grid, NSTAR, Western Massachusetts Electric, and Fitchburg Gas and Electric.

[3] *MASTERING THE UTILITY TRACKING NIGHTMARE* at mass.gov/doer

3. **Gas utility data:** DHCD is currently collecting gas utility data for eight housing authorities with over 900 utility accounts. They are collecting data from the state's three largest investor-owned gas utilities: KeySpan, NSTAR Gas, and BayState Gas.

4. **Reporting on the EIS:** As of today, DHCD is reporting data on the EIS for the housing authorities listed below. Together, these housing authorities have over 1,000 electric utility accounts and consume 50,000,000 kWh of electricity per year.

Brookline	Newton	Salem
Chelsea	North Adams	Waltham
Haverhill	North Andover	Watertown
Lawrence	Northampton	Woburn
Lynn		

5. **Next authorities tentatively planned for the EIS.**

Amesbury	Fall River	Somerville
Attleboro	Ludlow	Springfield
Belmont	New Bedford	Taunton
Boston	Norton	Worcester
Cohasset	Saugus	

Current EIS Activities

City of Cambridge

In January 2006 during the height of the natural gas price crisis, Ellen Katz of the Cambridge Department of Public Works called Eileen McHugh at DOER for some guidance regarding utility bill monitoring options. The City Manager had requested a bottom line answer to how much the City was paying for energy in all of its properties. Ms. Katz faced the challenge of collecting utility bills from all of the different city agencies to answer the Manager's question. She understood the amount of work required to collect useful utility bill information because she had been creating her own spreadsheets of utility bill information for DPW managed accounts. Eileen suggested that Cambridge consider using Rebuild's EIS and provided a small cost share to help pay for the initial project start up.

Since that time Rebuild's contractor, Peregrine Energy Group, has worked closely with the City of Cambridge to collect over 20,000 gas and electric utility bills online for all of Cambridge's departments. The system has been active since October 2006. The City currently uses the EIS system to prepare its annual energy budget, to prioritize its properties for energy efficiency projects, and to track savings from completed projects. The system offers a painless way to manage the City's energy programs.

MA Department of Housing & Community Development

MA Department of Housing & Community Development (DHCD)'s Public Housing Division funds and oversees approximately 50,000 public housing apartments in Massachusetts. Utility bill information is a significant challenge for DHCD both from an ongoing operating cost reimbursement and an energy efficiency investment perspective. The two primary goals for the EIS project have been to collect as much utility information for state-funded public housing from the state's investor-owned utility providers as possible and to help collect and distribute baseline utility data for housing authority energy performance contract projects. Most recently Rebuild staff has upgraded the EIS to include DHCD's energy performance contract monitoring and verification calculations.

Utility data collection Peregrine worked closely with the major investor-owned utilities to streamline data collection for Rebuild's EIS customers. National Grid and KeySpan Energy have been the most cooperative utility companies to date. National Grid has provided a complete database of electricity utility information for housing authority accounts located in its service territory. KeySpan has provided a database of natural gas utility information.

A current project DHCD has initiated to take advantage of this utility information is to identify and match all-electric "667" developments using the National Grid database to identify high use all-electric developments that might be ripe for energy efficiency upgrades.

ESCO project utility data collection Peregrine worked closely with DHCD staff to collect and integrate EIS utility data into two recent utility energy performance contract Requests for Responses (RFR). The primary lessons learned included the need to package the utility data into discreet building and utility data summaries. Additional considerations for future RFR data collection projects will include simplified data entry options and earlier staging of the data collection during the preliminary energy audit phase.

ESCO project monitoring and verification DHCD's energy performance contract monitoring and verification calculations have been incorporated into the EIS. With these calculations, the EIS can be used to calculate the initial three-year baseline for a performance contract project and to perform ongoing monitoring and verification calculations at DHCD's or an individual housing authority's request.

MA Executive Office of Energy and Environmental Affairs

The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) manages the State "Leading by Example" Program. The program measures progress toward sustainability goals and produces an annual report on sustainability efforts in Massachusetts State Government operations. Understanding and measuring the environmental impacts of Massachusetts agency operations is a key component of the program.

Given the size of Massachusetts state government, and the fact that electricity usage is spread over scores of agencies and thousands of accounts, collecting and reporting state agency electricity use data is an enormous challenge. The Rebuild EIS has greatly simplified this task, collecting and reporting electricity use data for nearly 3,000 accounts and calculating the greenhouse gas emissions associated with that use.

Benchmarking Building Performance

As a general rule utility bills by themselves answer two questions: "how much energy (or water) did I use?" and "how much did I have to pay for the energy (or water) that I used?" When building and equipment information is entered on the EIS at the same time utility bill information is entered, the EIS can answer two more important questions: "what did I use my energy (or water) for?" and "how does my energy use compare to other buildings?"

Figure 1 includes a list of major uses for energy and water consumption in multifamily buildings. The EIS allows agencies to link individual utility accounts to these specific types of uses and identify the major energy and water consumption components of the utility bills. Armed with this information the building energy manager and/or decision makers can answer the question "what did I use my energy (or water) for?" The Lawrence Housing Authority, for example, used this information to identify how much energy it was using for heating and domestic hot water (DHW) in the apartments.

FIGURE 1: MULTIFAMILY UTILITY CONSUMPTION CATEGORIES

Use - Air Condition
Use – Apartment
Use - Cold Water
Use – Common
Use – DHW
Use – Heat
Use - Non-Heat
Use – Other
Use - Outdoor Water

Figure 2 lists the major variables that affect multifamily energy and water use and cost. Similar to the energy use categories mentioned above, the EIS allows agencies to link individual utility accounts to these specific types of equipment and building variables. Armed with this information the building energy manager and/or decision makers can answer the question "how does my energy use compare to other buildings?" The Lawrence Housing Authority, for example, used this information to identify which heating and DHW systems and which buildings used the least amount of energy. In this case, the EIS confirmed that gas consumption is significantly higher in buildings with atmospheric gas boilers than in buildings with condensing boilers.

FIGURE 2: MULTIFAMILY BUILDING DESCRIPTORS AND ENERGY CONSUMPTION VARIABLES

Average Air Exchange Per Hour
Building Type
Design Heat Loss - Conduction
Design Heat Loss – Infiltration
Design Heat Loss – Total
Design Outdoor Temperature
DHW Boiler – Type
DHW Burner – Type
DHW Exchange – Type
Elevator – Type
Generation – Type
Heating Boiler – Type
Heating Burner – Type
Heating Distribution Loop - Type
Heating Distribution Terminals - Type
Irrigation – Type
Meter – Type
Occupants – Total
Residents
Water Fixtures – Type
Year Built

Another project managed by the non-profit energy company New Ecology provides a good example how the EIS can be used on a larger scale as a benchmarking tool to identify high use multifamily buildings and opportunities for energy and water efficiency investments. New Ecology is using the EIS to collect electric and gas bills for in Community Development Corporations located in Cambridge and Boston. The database will include utility bills for up to 6500 apartments. The goal of the project is to help CDC building owners understand how their building energy use compares to other similar buildings and how much lower the energy use could be with more efficient equipment.

Ease of Use Features

The EIS currently offers more that 400 "fields" of information to choose from. The fields range from simple utility data entry information to more complex building performance information such as source kBtu per square foot per heating degree day. Figure 3 summarizes the list of standard reports that Peregrine has prepared to facilitate the use and analysis of the most important fields of information. Individual agencies can customize the reports and save them as personal reports or make the reports available to everyone. A demonstration of the EIS is the best way to see the individual reports and learn how individual agencies can use the reports to manage building energy and water use, cost, and price information.

FIGURE 3: STANDARD REPORTS AVAILABLE ON EIS

Global Reports

TITLE ↑	CREATE DATE
1000 - Budget Analysis - Total Cost	05/25/2007
1100 - Budget Analysis - Electricity	05/31/2007
1110 - Budget Analysis - Electricity (PY)	05/31/2007
1210 - Budget Analysis - Gas (PY)	05/31/2007
1310 - Budget Analysis - Oil (PY)	05/31/2007
1410 - Budget Analysis - Water (PY)	05/31/2007
2000 - Bill Analysis - Total Cost	05/22/2007
2100 - Bill Analysis - Electricity	05/30/2007
2200 - Bill Analysis - Gas	05/30/2007
2300 - Bill Analysis - Oil	05/30/2007
2400 - Bill Analysis - Water	06/01/2007
3100 - Consumption Analysis - Electricity	05/23/2007
3110 - Consumption Analysis - Electricity (PY)	05/31/2007
3210 - Consumption Analysis - Gas (PY)	05/31/2007
3310 - Consumption Analysis - Oil (PY)	05/31/2007
3410 - Consumption Analysis - Water (PY)	05/31/2007
4100 - Meter Analysis - Electricity	05/30/2007
4200 - Meter Analysis - Gas	05/30/2007
4300 - Meter Analysis - Oil	05/30/2007
4400 - Meter Analysis - Water	05/30/2007
5000 - Emissions - Total CO2	05/30/2007
5100 - Emissions - Electric CO2, Nox, SO2	05/30/2007
5500 - Benchmark Analysis (per Square Foot)	05/25/2007
5600 - Benchmark Analysis (per Apartment)	05/30/2007
6000 - Performance Analysis (sq ft) - Total	05/30/2007
6100 - Performance Analysis (apt) - Total	05/30/2007
Property information by account	05/29/2007

Summary

The use of this automated, electronic energy information system demonstrates that it is possible to provide large amounts of transparent, readily available, online utility and building performance information to a wide audience of energy and water efficiency stakeholders. The initial experience of Rebuild Massachusetts early adopter agencies indicates that consistent use of the system creates an increasing level of comfort working with utility and building performance information. This has proven true whether it is at the individual building and utility account level or at the highest level of summary consumption, cost, and greenhouse gas emissions analysis.

For more information about this project, please contact Eileen McHugh at the Division of Energy Resources, 617-727-4732.